The invention claimed is:

- 1. A glass composition comprising:

 a germanium-silicon oxide or oxynitride having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1.
- 2. The glass composition of claim 1, wherein the Ge/(Si + Ge) mole ratio is about 0.35 and the N/(N + O) mole ratio is about 0.05.
- 3. The glass composition of claim 1 exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about 3 x 10^{-6} °C⁻¹ to about 4.4 x 10^{-6} °C⁻¹.
- 4. The glass composition of claim 1 exhibiting a refractive index of from about 1.48 to about 1.52 at 1550 nm, and having a coefficient of thermal expansion at room temperature of from about $3 \times 10^{-6} \, ^{\circ}\text{C}^{-1}$ to about 4.4 $\times 10^{-6} \, ^{\circ}\text{C}^{-1}$.
- 5. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a germanium-silicon oxide or oxynitride material having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of from 0 to about 0.1.

- 6. The planar optical device of claim 5, wherein the Ge/(Si + Ge) mole ratio is about 0.35 and the N/(N + O) mole ratio is about 0.05.
- 7. The planar optical device of claim 6, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.
- 8. The planar optical device of claim 7, wherein the planar optical device is a cross-connect optical switching device.

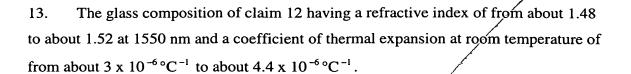
9. A method of forming a planar optical device on a silicon substrate, wherein the device includes a waveguide having a refractive index of from about 1.48 to about 1.52 at 1550 nm, and a coefficient of thermal expansion of from about 3 x 10^{-6} °C⁻¹ to about 4.4 x 10^{-6} °C⁻¹, comprising:

depositing on a silicon substrate by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride cladding layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1;

depositing on the cladding layer by plasma enhanced chemical vapor deposition a germanium-silicon oxide or oxynitride core layer having a Ge/(Si + Ge) mole ratio of from about 0.25 to about 0.47 and an N/(N + O) mole ratio of 0 to about 0.1, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer.

- 10. The method of claim 9 further comprising annealing the cladding layer and the core layer to a temperature greater than 1,000 °C in an oxidizing atmosphere, and cooling the cladding layer and the core layer at a rate greater than 200 °C/hr to a temperature below the strain point of the glass.
- 11. The method of claim 9 wherein the core layer and the cladding layer are deposited by exposing a substrate to a reaction gas mixture including a silicon precursor, a germanium precursor, a nitrogen source, and optionally including a carrier gas, wherein the plasma is formed by two electrodes driven by separate RF power supplies and a region of the chamber that is grounded, and wherein the substrate is placed on one of the electrodes that is driven with a RF power supply having a frequency less than 1 MHz, and the other electrode is driven with a RF power supply having a frequency greater than 1 MHz.
- 12. A glass composition, comprising:

silica-germania-titánia having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08.



14. A planar optical device comprising:

a waveguide core and waveguide cladding, wherein at least one of the waveguide core and the waveguide cladding is a silica-germania-titania glass having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08.

- 15. The planar optical device of claim 14, wherein the planar optical device is an optical switch having liquid crystal switches located at intersecting waveguides.
- 16. The planar optical device of claim 15, wherein the planar optical device is a cross-connect optical switching device.
- 17. A method of forming a planar optical device on a silicon substrate, comprising: depositing on a silicon substrate by plasma enhanced chemical vapor deposition a silica-germania-titania cladding layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17/and a Ti/(Si + Ge + Ti) mole ratio of 0 to about 0.08; and

depositing on the cladding layer by plasma enhanced chemical vapor deposition a silica-germania-titania core layer having a Ge/(Si + Ge + Ti) mole ratio of from about 0.08 to about 0.17 and a Ti/(Si + Ge + Ti) mole ratio of from 0 to about 0.08, wherein the refractive index of the core layer is higher than the refractive index of the cladding layer,

wherein the device includes a waveguide having a refractive index of from about 1.48 to about 1.52 at 1550 nm and a coefficient of thermal expansion of from about $3 \times 10^{-6} \, ^{\circ}\text{C}^{-1}$ to about 4.4 x $10^{-6} \, ^{\circ}\text{C}^{-1}$.